

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
7 October 2004 (07.10.2004)

PCT

(10) International Publication Number
WO 2004/085033 A3

(51) International Patent Classification⁷: **B01D 53/14**,
53/48

(21) International Application Number:
PCT/US2004/007453

(22) International Filing Date: 11 March 2004 (11.03.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/456,354 21 March 2003 (21.03.2003) US

(71) Applicant (for all designated States except US): **DOW
GLOBAL TECHNOLOGIES INC.** [US/US]; Washing-
ton Street, 1790 Building, Midland, MI 48674 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SCHUBERT,
Craig, N.** [US/US]; 220 Moss Rose Lane, Lake Jackson,
TX 77566 (US). **ASHCRAFT, Arnold, C.** [US/US]; 838
Perrineville Road, Perrineville, NJ 08535 (US).

(74) Agent: **KARADZIC, Dragan, K.**; The Dow Chemical
Company, Intellectual Property Section, P.O. Box 1967,
Midland, MI 48674-1967 (US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), Euro-
pean (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,
GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

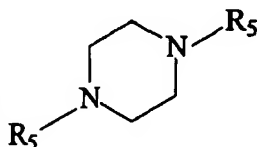
Published:

— with international search report
— before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments

(88) Date of publication of the international search report:
21 April 2005

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: IMPROVED COMPOSITION AND METHOD FOR REMOVAL OF CARBONYL SULFIDE FROM ACID GAS CON-
TAINING SAME



(III)

(57) Abstract: Novel solvent composition for selective removal of
COS from a gas stream containing same, said composition comprising
a) at least one polyalkylene glycol alkyl ether of the formula (I) or
1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone or a mixture of
N-formylmorpholine and N-acetylmorpholine Wherein R₁ is an alkyl group
having from 1 to 6 carbon atoms; R₂ is hydrogen or an alkyl group having

from 1 to 4 carbon atoms; Alk is an alkylene group, branched or unbranched, having from 2 to 4 carbon atoms, and n is from 1 to 10;
and b) at least one alkanolamine compound of the formula (II) or at least one piperazine compound of formula (III) wherein R₃ is
hydrogen, an alkyl group having from 1 to 6 carbon atoms, or the R₄OH group; R₄ is a branched or unbranched alkylene group
having from 1 to 6 carbon atoms; R₅, independently in each occurrence, is hydrogen or an hydroxyalkyl group having from 1 to
4 carbon atoms; and R₆ is hydrogen, an alkyl group having from 1 to 6 carbon atoms or an hydroxyalkyl group having from 1
to 4 carbon atoms.

INTERNATIONAL SEARCH REPORT

national Application No

PCT/US2004/007453

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B01D53/14 B01D53/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 589 149 A (GARLAND PAUL ET AL) 31 December 1996 (1996-12-31) cited in the application claims; example; table 1	1-18
X	US 4 336 233 A (APPL MAX ET AL) 22 June 1982 (1982-06-22) column 3, lines 25-44; claims 1,3	1-18
X	DATABASE WPI Section Ch, Week 198312 Derwent Publications Ltd., London, GB; Class J01, AN 1983-28999K XP002298099 & SU 927 282 B (NATURAL GAS PROCESS) 15 May 1982 (1982-05-15) abstract ----- -/-	1-18



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the International filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the International filing date but later than the priority date claimed

T later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

& document member of the same patent family

Date of the actual completion of the International search

10 February 2005

Date of mailing of the International search report

24.02.2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Gruber, M

INTERNATIONAL SEARCH REPORT

International Application No
T/US2004/007453

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 101 39 453 A (BASF AG) 20 February 2003 (2003-02-20) column 3, paragraphs 15,16 -----	1-18
X	DE 39 22 904 A (CASSELLA AG) 17 January 1991 (1991-01-17) page 2, lines 43-52; claims 1-3 -----	1-9
A	US 6 277 345 B1 (STANKOWIAK ACHIM ET AL) 21 August 2001 (2001-08-21) cited in the application the whole document -----	1-18
A	US 4 504 449 A (DOERGES ALEXANDER ET AL) 12 March 1985 (1985-03-12) cited in the application the whole document -----	1-18
A	US 4 705 673 A (BUTWELL KENNETH F ET AL) 10 November 1987 (1987-11-10) the whole document -----	
X	DE 38 28 513 A (MERCK PATENT GMBH) 1 March 1990 (1990-03-01) claims 1,2; table 2 -----	19
A	US 4 183 903 A (MELCHIOR, MICHAEL T ET AL) 15 January 1980 (1980-01-15) the whole document -----	19,20
A	US 4 545 965 A (GAZZI ET AL) 8 October 1985 (1985-10-08) claim 1 -----	21,22
A	EP 0 008 449 A (DOW CHEMICAL CO) 5 March 1980 (1980-03-05) page 3, line 5 - page 4, line 4 -----	21,22
A	US 6 102 987 A (GROSS ET AL) 15 August 2000 (2000-08-15) cited in the application the whole document -----	21,22

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2004/007453

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-18

Solvent composition comprising
(a) at least one polyalkylene glycole alkyl ether, and
(b) at least one alkanolamine
or
at least one piperazine, and
process for selective removal of COS from a gas stream
containing COS and CO₂ using the composition.

2. claims: 19,20

Solvent composition comprising
(a) 1,3,-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone and
(b) at least one alkanolamine
or
at least one piperazine, and
process for selective removal of COS from a gas stream
containing COS and CO₂ using the composition.

3. claims: 21,22

Solvent composition comprising
(a) a mixture of N-formylmorpholine and N-acetylmorpholine
and
(b) at least one alkanolamine
or
at least one piperazine, and
process for selective removal of COS from a gas stream
containing COS and CO₂ using the composition.

INTERNATIONAL SEARCH REPORT

Information on patent family members

national Application No

T/US2004/007453

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5589149	A	31-12-1996	US 5705090 A	06-01-1998
			AT 179088 T	15-05-1999
			AU 8132494 A	29-05-1995
			CA 2176222 A1	18-05-1995
			DE 69418055 D1	27-05-1999
			DE 69418055 T2	16-09-1999
			EP 0728033 A1	28-08-1996
			ES 2132590 T3	16-08-1999
			HU 76515 A2	29-09-1997
			WO 9513128 A1	18-05-1995
US 4336233	A	22-06-1982	DE 2551717 A1	02-06-1977
			AT 365942 B	25-02-1982
			AT 854176 A	15-07-1981
			BE 848483 A1	18-05-1977
			CA 1090098 A1	25-11-1980
			CS 219323 B2	25-03-1983
			ES 453391 A1	16-03-1978
			FR 2332049 A1	17-06-1977
			GB 1560905 A	13-02-1980
			JP 1355979 C	24-12-1986
			JP 52063171 A	25-05-1977
			JP 61019286 B	16-05-1986
			NL 7612855 A ,B,	23-05-1977
SU 927282	B	15-05-1982	SU 927282 A1	15-05-1982
DE 10139453	A	20-02-2003	DE 10139453 A1	20-02-2003
			WO 03013699 A1	20-02-2003
DE 3922904	A	17-01-1991	DE 3922904 A1	17-01-1991
US 6277345	B1	21-08-2001	DE 19854353 A1	21-06-2000
			AT 246953 T	15-08-2003
			DE 59906575 D1	18-09-2003
			EP 1004344 A1	31-05-2000
			ES 2205679 T3	01-05-2004
US 4504449	A	12-03-1985	DE 3222588 A1	22-12-1983
			CA 1205277 A1	03-06-1986
			DE 3365264 D1	18-09-1986
			EP 0096907 A1	28-12-1983
			IN 157655 A1	10-05-1986
			JP 1640584 C	18-02-1992
			JP 3000085 B	07-01-1991
			JP 59006922 A	14-01-1984
US 4705673	A	10-11-1987	CA 1246527 A1	13-12-1988
DE 3828513	A	01-03-1990	DE 3828513 A1	01-03-1990
US 4183903	A	15-01-1980	US 4343716 A	10-08-1982
US 4545965	A	08-10-1985	IT 1132170 B	25-06-1986
			AU 542254 B2	14-02-1985
			AU 7145381 A	07-01-1982
			BE 889467 A1	04-01-1982
			BR 8103870 A	09-03-1982

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/007453

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4545965	A		CA 1165098 A1	10-04-1984
			CH 649473 A5	31-05-1985
			DD 200979 A5	29-06-1983
			DE 3126136 A1	11-03-1982
			DK 277081 A	05-01-1982
			EG 15364 A	31-03-1986
			ES 8205131 A1	16-09-1982
			FR 2485945 A1	08-01-1982
			GB 2079307 A ,B	20-01-1982
			GR 74572 A1	29-06-1984
			IE 51368 B1	10-12-1986
			IN 155271 A1	12-01-1985
			JP 57047705 A	18-03-1982
			LU 83463 A1	17-02-1982
			NL 8103203 A	01-02-1982
			NO 812120 A ,B,	05-01-1982
			NZ 197203 A	31-05-1984
			PL 231781 A1	15-02-1982
			SE 445711 B	14-07-1986
			SE 8104151 A	05-01-1982
			SU 1309902 A3	07-05-1987
			YU 164881 A1	31-10-1983
EP 0008449	A	05-03-1980	AU 530333 B2	14-07-1983
			AU 4961579 A	28-02-1980
			CA 1124038 A1	25-05-1982
			DE 2965112 D1	05-05-1983
			EP 0008449 A1	05-03-1980
			JP 55031491 A	05-03-1980
			US 4351812 A	28-09-1982
			ZA 7904121 A	30-07-1980
US 6102987	A	15-08-2000	DE 19753903 A1	24-06-1999
			CA 2246067 A1	05-06-1999
			CN 1218711 A	09-06-1999
			DE 59804040 D1	13-06-2002
			EP 0920901 A2	09-06-1999
			NO 985702 A	07-06-1999